

14.5.3 $z = \sin \theta \cos \phi$ $\theta = 5t^9$ $\phi = 5^6 t$

$$\frac{\partial z}{\partial s} = \frac{\partial z}{\partial \theta} \frac{\partial \theta}{\partial s} + \frac{\partial z}{\partial \phi} \frac{\partial \phi}{\partial s}$$

$$\frac{\partial z}{\partial \theta} = \cos \theta \cos \phi \quad \frac{\partial z}{\partial \phi} = -\sin \theta \sin \phi$$

$$\frac{\partial \theta}{\partial s} = t^9 \quad \frac{\partial \phi}{\partial s} = 75^6 t$$

$$\frac{\partial z}{\partial s} = \cos \theta \cos \phi (t^9) - \sin \theta \sin \phi 75^6 t$$

$$\frac{\partial z}{\partial s} = (\cos \theta \cos \phi (t^9) - \sin \theta \sin \phi 75^6 t)$$

14.5.5 $x = g(t)$ $y = h(t)$ $t=4$

$$\frac{dz}{dt} = \frac{\partial z}{\partial x} \frac{dx}{dt} + \frac{\partial z}{\partial y} \frac{dy}{dt}$$

$$t=4 \quad f_x(g') + f_y(h') \quad g(4)=1 \quad h(4)=5$$

$$f_x(g'(4)) + f_y(h'(4))$$

$$f_x(1,5) g'(4) + f_y(1,5) h'(4)$$

$$-9(-8) + 9(-5)$$

$$72 - 45$$

$$27$$

$$w_3(4, -4)$$

14.5.6



$$\frac{dw}{ds} = \frac{\partial w}{\partial u} \frac{du}{ds} + \frac{\partial w}{\partial v} \frac{dv}{ds}$$

$$f_u\left(\frac{du}{ds}\right) + f_v\left(\frac{dv}{ds}\right)$$

$$-8(-2) + (-5)(2)$$

$$16 - 10$$

$$6$$

7.) $F(e^u + \sin v, e^u + \cos v)$

$$\frac{\partial g}{\partial u} = \frac{\partial f}{\partial x} \frac{\partial x}{\partial u} + \frac{\partial f}{\partial y} \frac{\partial y}{\partial u} \quad x = x(u, v) \quad y = y(u, v)$$

$$f_x(e^u) + f_y(e^u) \Big|_0 \quad (1, 2) = f(0, 0)$$

$$f_x(1, 2)e^0 + f_y(1, 2)e^0$$

$$2(1) + 8(1)$$

$$10$$

9.) $x^2 + 4y^2 + 9z^2 = 1$ $x = x(x, y)$ $y = y(x, y)$ $z = z(x, y)$

$$x = x$$

$$y = y$$

$$z = z$$

$$F(x, y, z) = 0$$

$$\frac{\partial F}{\partial x} = 0 = \frac{\partial F}{\partial x} \frac{\partial x}{\partial x} + \frac{\partial F}{\partial y} \frac{\partial y}{\partial x} + \frac{\partial F}{\partial z} \frac{\partial z}{\partial x}$$

$$0 = f_x + f_y 0 + f_z \frac{\partial z}{\partial x}$$

$$-f_x = f_z \frac{\partial z}{\partial x}$$

$$-\frac{f_x}{f_z} = \frac{\partial z}{\partial x}$$

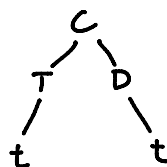
$$\frac{\partial F}{\partial x} = 2x \quad \frac{\partial F}{\partial y} = 8y$$

$$\frac{\partial F}{\partial z} = 18z$$

$$\frac{\partial z}{\partial x} = -\frac{2x}{18z}$$

$$\frac{\partial z}{\partial y} = -\frac{8y}{18z}$$

$$\frac{\partial z}{\partial x} = -\frac{x}{9z} \quad \frac{\partial z}{\partial y} = -\frac{4y}{9z}$$



$$\frac{dc}{dt} \text{ when } t=20$$

$$\frac{\partial C}{\partial T} \frac{dT}{dt} + \frac{\partial C}{\partial D} \frac{dD}{dt}$$

$$\frac{dT}{dt} = -\frac{2}{15}$$

$$\frac{dD}{dt} = \frac{1}{2}$$